Due Wednesday, April 7   EE572   HW #18

Note: Pre-Lab 4 is also due next Monday. You should be able to do it, now.

1.a) Determine the type number of the following open-loop Z-domain transfer functions:

$i)\,G(z)=\frac{10(z+1)^2}{z(z-1)}$ $ii)\,G(z)=\frac{10(z+1)^3}{z^2(z-1)}$ $iii)\,G(z)=\frac{10(z+1)^3}{z(z-1)^2}$

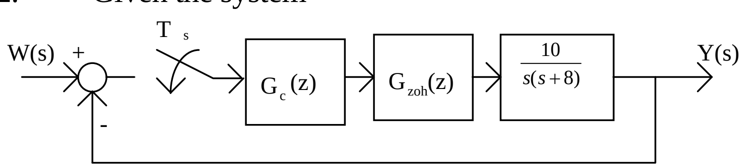
b) Let T_s=100 msec and find the static error coefficients K_p, K_v and K_a for problem 1a) (assume unity feedback).

c) For each of the closed-loop unity feedback systems in part a), find:

i)e_{ss} due to a step   ii)e_{ss} due to a ramp   iii)e_{ss} due to a parabola

d) Sketch the root locus for the systems in part a).

2. Given the system



a) Find a Z-domain model for the open-loop system including the ZOH if T_s = 10 msec.

b) What type number is your Z-domain model? What type is the original model?

c) Find e_{ss} due to a step, e_{ss} due to a ramp, and e_{ss} due to a parabola for your uncompensated Z-domain model.

d) Given the following transient specifications: t_s < 0.4 sec and M_p < 2%. Illustrate the region of the s-plane and the z-plane where we must place our dominant poles to satisfy these specs.

e) Design Gc(z) (plus possibly a lag compensator) to meet the above specs plus the added spec that e_{ss} due to ramp ≤ 1/50.

f) Simulate a step and ramp response of your closed-loop compensated digital system using dlsim() in MATLAB. Measure t_s, M_p, and e_{ss} (both step and ramp).

g) How do your digital compensator numbers compare to the Gc(z) we designed for this system in HWs #16 and #17?